

Incidence and Management of Tooth Root Fracture in Mandibular Fracture Line - A Retrospective Study

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Abstract

Introduction: In cases of trauma, the most common fractures of the facial region are the nasal bone fractures followed by mandibular fractures. About 60% of mandible fractures are associated with teeth in the fracture line; however conversely, the dentulous mandible has a higher susceptibility of fracture in any impact. Whenever a tooth is involved in the fracture line, it is not unlikely that the tooth root fracture will be associated with it. The prognosis and treatment of such a tooth persistent in a fracture line depends upon the level of tooth root fracture. **Materials and Methods:** This retrospective study was conducted in the Department of Oral and Maxillofacial Surgery in a Meerut hospital. The eligibility criteria were based on the cases involving fracture line passing through the teeth bearing area of mandible. Total of 56 cases of mandibular fracture treated from January 2021 till December 2022 by open reduction and fixation were included in the study. **Results:** A total of 56 patients (66 fracture lines) with mandibular fractures were selected, out of which 18 (32%) patients had fracture of the root of the tooth in the fracture line. Third molar root fracture were present in 12 cases (66.6%), first premolars in 4 cases (22.2%), and first molars in 2 cases (11.1%). There were 14 multi rooted teeth (77.7%) and 4 single rooted teeth (22.2%) involvement. All the multi rooted teeth fracture were treated by extraction during open reduction and fracture fixation. The single rooted teeth were successfully treated by endodontic treatment postoperatively. **Discussion:** The fracture line passing through the dentate segment may fracture the tooth crown and/or root or propagate through the socket without any injury to the root. Root fracture at cervical and middle third is constantly exposed to oral fluids. The affected tooth may be mobile and lose vitality. Teeth in the line of fracture must be removed when they preclude the correct reduction of the segments or if they represent a risk for infection. If the tooth or root does not cause any hindrance during reduction or it is not infected, the tooth can be salvaged by endodontic therapy. The incidence of root fracture was seen in 32% of cases. Fracture of the third molar roots was the single largest group (66.6%). No root fracture was observed in the anterior segment.

Keywords: Mandibular fracture, root fracture, extraction

INTRODUCTION

Mandibular fractures in the teeth-bearing segment is in constant communication with oral environment. The injury to the tooth or teeth implicated at the fracture site may be in the form of crown fracture, root fracture, subluxation or tooth avulsion. The concerned tooth could be damaged and lose its vitality or it could already have pulpal, periodontal or periapical pathology.^[1]

Before the development of antibiotics, prophylactic tooth extraction at the fracture line was recommended as a means of avoiding serious consequences including osteomyelitis, malunion or non-union. Recent advances in early intervention and internal fixation and antibacterial prophylaxis have considerably aided in tooth preservation.^[2] Extraction of tooth

in fracture line is indicated when the tooth is fractured, grossly carious, exposed with or without periapical pathology and interferes with fracture reduction or fixation. However, there is still disagreement in the literature about the care of teeth that are asymptomatic at the time of fixation or the evidence-based reasons for tooth extraction.^[3]

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The crown or root of the tooth involved in a fracture line may be damaged in cases of mandibular fractures. Coronal fractures up to Ellis Class 3 can be maintained and treated conservatively. The prognosis is poor for vertical tooth root fractures and fractures involving the cervical third of the crown and root. When the fracture is located in the apical or middle third of the root, the prognosis is favourable.^[4] The present study is conducted to identify the incidences of injury to the roots of teeth and fate of the tooth in the line of mandibular fracture.

Aim

The aim of the study is to assess the root fracture in cases of fracture of mandible.

Objectives

1. The incidence of root fracture of single-rooted tooth
2. The incidence of root fracture of multirooted tooth (whether one or both roots are involved)
3. Bilateral root fracture in cases of bilateral mandibular fracture
4. The treatment done for the involved tooth, extraction or conservative management.

MATERIALS AND METHODS

This retrospective study was conducted in a tertiary care teaching hospital after obtaining clearance from the ethical committee vide letter no SMC/UECM/2023/628/296. Cases of maxillofacial trauma reported and referred from peripheral centres from January 2021 through December 2022 were taken into consideration.

The following inclusion criteria were applied.

1. Age group between 18 and 60 years
2. Both sexes
3. Cases of isolated mandibular fracture, multiple mandibular fracture and panfacial trauma where at least one fracture line passing through the teeth-bearing segment of mandible.

The exclusion criteria were as follows:

1. History of previous trauma and surgical intervention
2. Incomplete data
3. Edentulous mandibular fracture
4. Medically compromised cases
5. Post-operative follow-up <6 months.

The cases of trauma reported to triage were evaluated clinicoradiologically. Pre-anaesthetic assessment was carried out, and the patients were operated under general anaesthesia. Teeth with broken roots and considered unsalvageable were extracted. The fractured segments were reduced and stabilised with titanium miniplates and screws. Post-operative care and medications were given as per the institutional protocol. The cases were followed up for at least a period of six months.

Data collection was carried out and analysed using the SPSS software (IBM, Chicago, U.S). $P < 0.05$ is considered statistically significant.

RESULTS

There were 56 patients with 66 fracture lines, 46 unilateral and 10 cases of bilateral fracture. The age range is 18–55 years, with the average age of 36.5 years. There were 48 males and 8 females. Eighteen (32%) cases had involvement of the roots in the line of fracture. Out of 18 patients, eight had involvement of tooth on the left side of jaw, six patients on the right side and four patients had bilateral involvement of roots of the teeth [Figure 1]. There was no involvement of the roots in the anterior segments, that is mandibular symphysis and parasymphysis fractures. All the root fractures were seen in posterior segment. Third molar root fracture was present in 12 cases (66.6%), first premolars in four cases (22.2%) and



Figure 1: Orthopantomogram showing bilateral root fractures marked with an arrow

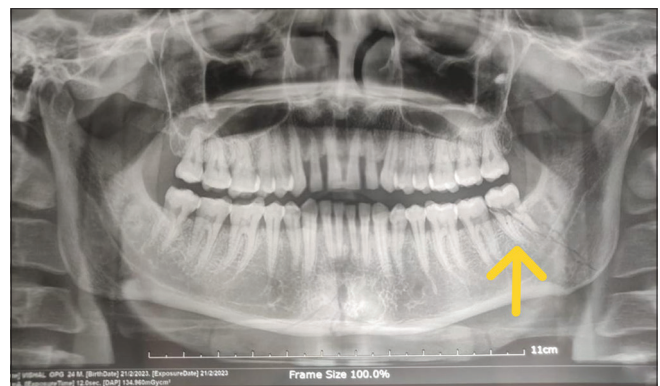


Figure 2: Orthopantomogram showing both mesial and distal root fractures in mandibular third molar marked with an arrow



Figure 3: Post-operative orthopantomogram with extraction of involved tooth marked with an arrow

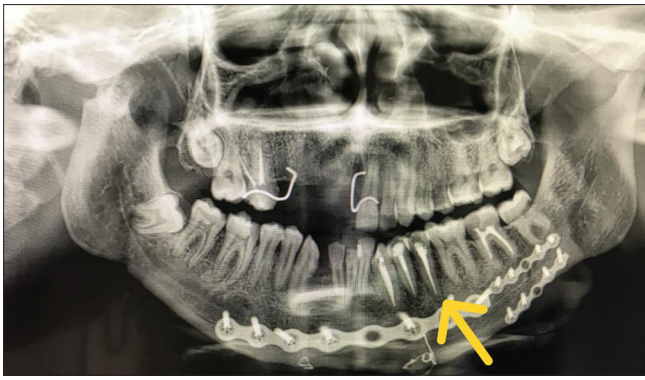
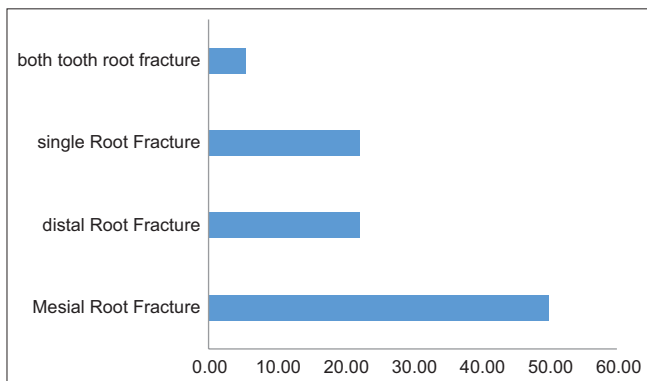


Figure 4: Post-operative orthopantomogram showing completion of root canal treatment marked with an arrow



Graph 2: Involvement of tooth root in fracture line

first molars in two cases (11.1%) [Graph 1]. There were 14 multirooted teeth and four single-rooted teeth involvement.

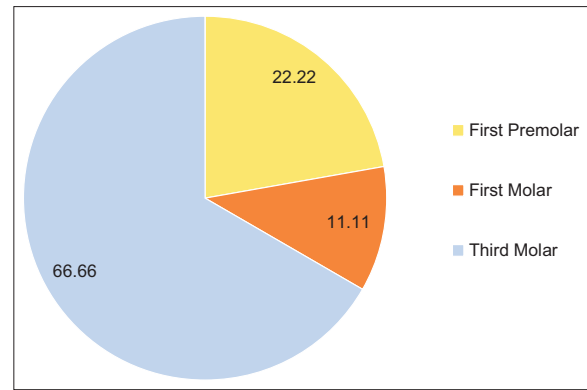
Amongst the patients with fracture of multirooted teeth, nine patients were found to have a mesial root fracture and four patients were found to have a distal root fracture and one patient had both mesial and distal root fracture [Figure 2 and Graph 2]. All the multirooted tooth root fractures were at the cervical or middle third. However, there was involvement of only first and third molar, whereas second molars were spared. Amongst single-rooted tooth, four patients accounted for root fractures of mandibular first premolar in the apical third.

On anatomical distribution, six cases were associated with mandibular body fracture, whereas 12 cases with mandibular angle fracture. In 14 patients, the involved tooth was extracted during fracture fixation [Figure 3] and four cases underwent endodontic therapy at a later stage [Graph 3] and [Figure 4].

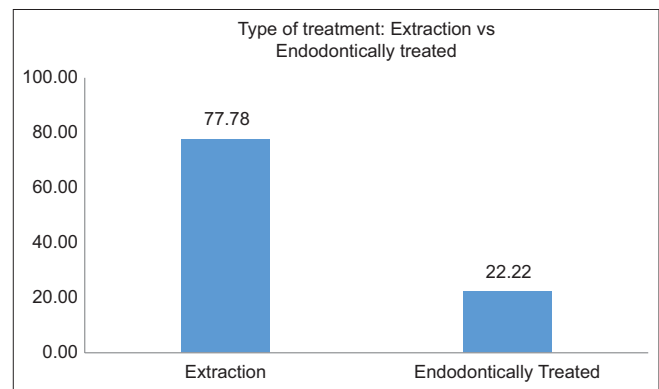
DISCUSSION

The common anatomical sites of mandibular fractures are condyle (29.1%), angle (24.5%), symphysis (22%) and body (16%). Fracture line passing through the tooth-bearing segment is prevalent in 60% of cases of mandibular fracture.^[5,6]

The fracture line passing through the dentate segment may fracture the tooth crown and/or root or propagate through the socket without any injury to the root. The most commonly



Graph 1: Involvement of tooth in the fracture line



Graph 3: Treatment modality of tooth in fracture line

involved tooth in the fracture line is the mandibular third molar.^[7] It is due to the position of mandibular third molar which is at the angle of the mandible which is supposed to be the zone of transition from the horizontal axis to vertical axis. This leads to the unequal distribution of the mechanical forces acting on the mandible during a trauma which in turn makes the mandibular angle, the most common site of fracture and mandibular third molar to be the most commonly involved tooth in the fracture line in cases of mandible fracture. In our study, the incidence of the third molar root fracture was highest.

According to Soós *et al.*, the risk of mandible fractures is 3.27 times higher in the presence of a lower third molar. The presence of a third molar makes the mandibular angle weaker and increases its fracture risk. This phenomenon may be related to the disrupted cortical layer due to a superficially impacted third molar. Another possible explanation is the occupation of the bone space by a totally impacted third molar.^[8] Therefore, bone surface area occupied by a multirooted tooth is more than that of a single-rooted tooth, thereby increasing the tooth bone ratio and leaving a lesser amount of bone in the jaw making the multirooted tooth root more susceptible to fracture. The curved roots of the multirooted tooth tend to fracture easily as the curvature makes the root weaker.

If the mechanical properties of the root and bone are evaluated, the mineral content of the tooth root is 61%, whereas the bone consists of 45% of mineral content.^[9] Hence, technically, the tooth

root is mechanically stronger than alveolar bone. There is a natural zone of tension at the upper border, leading to gaping of fractured segments at the upper border and zone of compression created at the lower border of the mandible.^[7] Hence, any fracture of the root at the cervical area is prone to infection due to contamination of the oral fluids. We extracted all the teeth with cervical root fracture to avoid any complication of fracture healing.

According to Kamboozia and Punnia-Moorthy, 68% of teeth involved in the fracture line are non-vital out of which 31% have been subjected to endodontic treatment and remaining 37% were extracted.^[10] The presence of non-vital teeth in the fracture line subjects the fracture site to post-operative infection, delayed or non-union.

In our series of 56 cases with 66 fracture sites, the mandibular symphysis and parasymphysis area accounted for 28 sites, mandibular angle 22 and mandibular body 16 sites. In spite of the higher incidences of symphysis and parasymphysis fractures, there was no root fracture in the anterior segment. Weakening of the mandibular structure due to elongated canine root and curvilinear shape are the contributory factor for higher incidence of symphysis and parasymphysis fracture. The mandible disperses the applied stress over its length. The areas where the force per unit area generated is larger, there is increase in the concentration of tensile strength causing a fracture at the point where the curvature is most convex. The presence of an impacted third molar has been explained to occupy a large osseous space within the bone at the mandibular angle, thus reducing the total bone surface area, leading to a greater susceptibility to fracture.^[11]

Mandibular angle fracture is the most common in cases of physical assault and isolated fractures. The literature supports the fact that the presence of a third molar in the angle region increases the probability of fracture by 2.7 times.^[5] In our study, we found that the incidence of third molar root fracture was highest (66.6%) amongst all the teeth.

Root fracture at cervical and middle third is constantly exposed to oral fluids. The affected tooth may be mobile and lose vitality. Fracture of both the roots in molars make the situation further complicated. Teeth in the line of fracture must be removed when they preclude the correct reduction of the segments or if they represent a risk for infection.^[12] These teeth are more likely to get displaced and interfere in fracture reduction and fixation. Endodontic therapy may not be successful.

Extraction of tooth in the fracture line is controversial. According to several studies, keeping the tooth resulted in a lower complication rate.^[4] The retention of the tooth depends on the level of fracture and the status of infection of the root. Extraction is indicated when the reduction difficult or impossible, roots are fractured, tooth is impacted, having periapical pathology and poor periodontal condition. In our study, all multirrooted teeth with root fracture were extracted. All single-rooted teeth having fracture at apical third were treated endodontically.

All the cases in the study group were followed up for a period of at least 6 months, and there was no complication.

CONCLUSION

The incidence of root fracture was seen in 32% of cases. Fracture of the third molar roots was the single largest group (66.6%). No root fracture was observed in the anterior segment. All the multirrooted teeth having root fracture were treated by extraction during open reduction and fixation. All the single-rooted teeth had root fracture at apical third and successfully treated by endodontic treatment post-operatively.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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